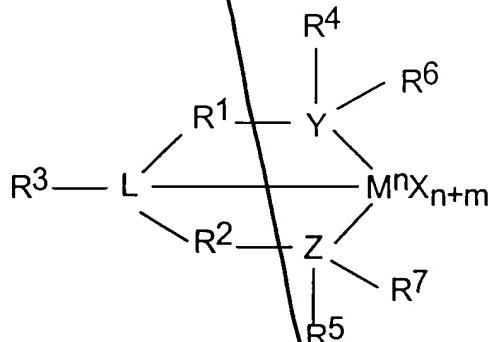


Claims:

1. A polymerization process comprising combining in the gas or slurry phase an olefin with an activator, a support and a compound represented by the following formula:

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wherein

M is a group 3 to 14 metal,

each X is independently an anionic leaving group,

n is the oxidation state of M,

m is the formal charge of the YZL ligand,

Y is a group 15 element,

Z is a group 15 element,

L is a group 15 or 16 element,

15 R¹ and R² are independently a C₁ to C₂₀ hydrocarbon group, a heteroatom containing group, silicon, germanium, tin, lead, phosphorus, a halogen,

R¹ and R² may also be interconnected to each other,

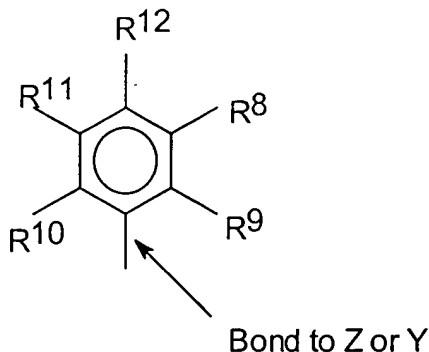
R³ is absent, or is hydrogen, a group 14 atom containing group, a halogen, a heteroatom containing group,

20 R⁴ and R⁵ are independently an aryl group, a substituted aryl group, a cyclic alkyl group, a substituted cyclic alkyl group, or multiple ring system,

R⁶ and R⁷ are independently absent or hydrogen, halogen, a heteroatom or a hydrocarbyl group, or a heteroatom containing group.

2. The process of claim 1 wherein M is a group 4, 5 or 6 transition metal.
3. The process of claim 1 wherein M is zirconium or hafnium.
- 5 4. The process of claim 1 wherein each X is independently hydrogen, halogen or a hydrocarbyl group
- 5 5. The process of claim 1 wherein R¹ and R² are independently a C₁ to C₆ hydrocarbon group.
- 10 6. The process of claim 1 wherein R¹ and R² are a C₁ to C₂₀ alkyl, aryl or aralkyl group.
7. The process of claim 1 wherein m is 0, -1, -2, or -3 and n is +3, +4 or +5.
8. The process of claim 1 wherein R³ is absent or hydrogen or methyl.
9. The process of claim 1 wherein R⁴ and R⁵ are independently a C₁ to C₂₀ hydrocarbon group.
- 20 10. The process of claim 1 wherein R⁴ and R⁵ are independently a C₁ to C₂₀ aryl group or a C₁ to C₂₀ aralkyl group.
11. The process of claim 1, wherein R⁴ and R⁵ are independently a cyclic aralkyl group.

12. The process of claim 1 wherein R⁴ and R⁵ are independently a group represented by the following formula:



wherein

each R⁸ to R¹² are independently hydrogen, or a C₁ to C₂₀ alkyl group, a heteroatom, or a heteroatom containing group having up to 40 carbon atoms, and any two R groups can combine to form a cyclic group or a heterocyclic group.

13. The process of claim 12 wherein
R⁸ is methyl, ethyl, propyl or butyl and/or
R⁹ is methyl, ethyl, propyl or butyl, and/or
R¹⁰ is methyl, ethyl, propyl or butyl, and/or
R¹¹ is methyl, ethyl, propyl or butyl and/or
R¹² is methyl, ethyl, propyl or butyl.

14. The process of claim 13 wherein
R⁹, R¹⁰ and R¹² are methyl and R⁸ and R¹¹ are hydrogen.

15. The process of claim 1 wherein the activator comprises alkyl aluminum compounds, alumoxanes, modified alumoxanes, non-coordinating anions, boranes, borates and/or ionizing compounds.

16. The process of claim 1 wherein the olefin comprises ethylene.

17. The process of claim 1 wherein the olefin comprises propylene.

5 18. The process of claim 1 wherein the olefin comprises ethylene and a C₃ to C₂₀ alpha olefin.

19. The process of claim 1, wherein the olefin comprises ethylene and hexene and/or butene.

10

20. The process of claim 1, wherein the polymer produced has a molecular weight of 200,000 Daltons or more.

21. The process of claim 1 wherein the transition metal compound and/or the activator are placed on a support before being placed in the gas or slurry phase.

22. The process of claim 21 wherein the support is a finely divided polyolefin, talc, or an oxide of silica, magnesia, titania, alumina, or silica-alumina.

23. The process of claim 1 wherein the transition metal compound and the activator are combined, then placed on a support, then placed in the gas or slurry phase.

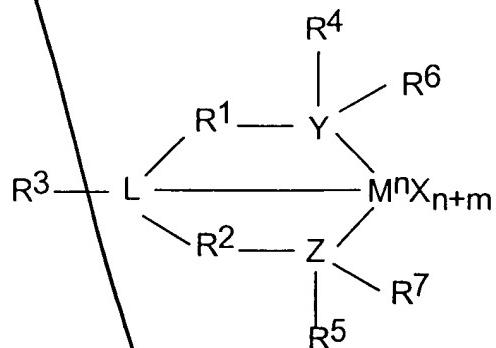
24. The process of claim 1 wherein a metal stearate is combined with the transition metal compound and/or the activator and/or a support.

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25. The process of claim 24 wherein the metal stearate is an aluminum stearate.

26. The process of claim 25 wherein the aluminum stearate is aluminum distearate.

27. A polymerization process comprising combining in the gas or slurry phase an olefin with an activator, a support and a compound represented by the following formula:



wherein

M is a group 3 to 14 metal,

each X is independently an anionic leaving group,

n is the oxidation state of M,

m is the formal charge of the YZL ligand,

Y is a group 15 element,

Z is a group 15 element,

L is a group 15 or 16 element,

R¹ and R² are independently a C₁ to C₂₀ hydrocarbon group, a heteroatom containing group, silicon, germanium, tin, lead, phosphorus, a halogen,

15 R¹ and R² may also be interconnected to each other,

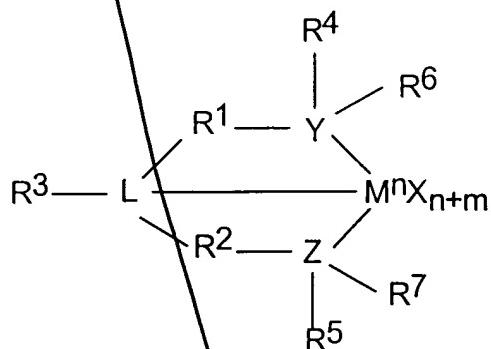
R³ is absent, or is hydrogen, a group 14 atom containing group, a halogen, a heteroatom containing group,

R⁴ and R⁵ are independently an aryl group, a substituted aryl group, a cyclic alkyl group, a substituted cyclic alkyl group, or multiple ring system,

20 R⁶ and R⁷ are independently absent or hydrogen, halogen, a heteroatom or a hydrocarbyl group, or a heteroatom containing group, provided however that L is bound to one of Y or Z and one of R¹ or R² is bound to L and not to Y or Z.

28. A process to produce a film comprising extruding, blowing or casting a film from polymer produced by a polymerization process comprising combining an olefin in the gas or slurry phase with an activator, a support and a compound represented by the following formula:

5



wherein

M is a group 3 to 14 metal,

each X is independently an anionic leaving group,

n is the oxidation state of M,

m is the formal charge of the YZL ligand,

Y is a group 15 element,

Z is a group 15 element,

L is a group 15 or 16 element,

15 R¹ and R² are independently a C₁ to C₂₀ hydrocarbon group, a heteroatom containing group, silicon, germanium, tin, lead, phosphorus, a halogen,

R¹ and R² may also be interconnected to each other,

R³ is absent, or is hydrogen, a group 14 atom containing group, a halogen, a heteroatom containing group,

20 R⁴ and R⁵ are independently an aryl group, a substituted aryl group, a cyclic alkyl group, a substituted cyclic alkyl group, or multiple ring system,

R⁶ and R⁷ are independently absent or hydrogen, halogen, a heteroatom or a hydrocarbyl group, or a heteroatom containing group.

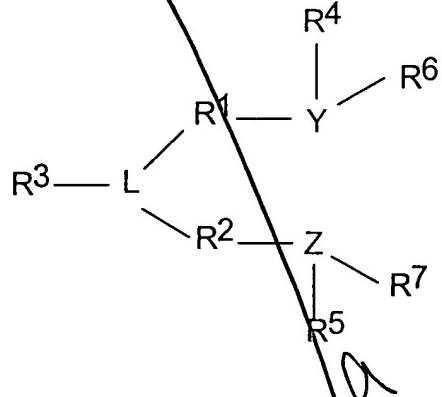
29. The method of claim 28 wherein the film is a blown film.

30. A method to prepare a metal compound comprising reacting a neutral ligand with a compound represented by the formula M^nX_n (where M is a group 3-14 metal, n is the oxidation state of M, X is an anionic group) in a non-coordinating or weakly coordinating solvent, at about 20 to about 100 °C, then treating the mixture with an excess of an alkylating agent, then recovering the metal complex.

31. The method of claim 30 wherein the solvent has a boiling point above 60 °C.

32. The method of claim 30 wherein the solvent is ether, toluene, xylene, benzene, methylene chloride and/or hexane.

33. The method of claim 30 wherein the neutral ligand is represented by the formula:



Y is a group 15 element,

Z is a group 15 element,

L is a group 15 or 16 element,

R¹ and R² are independently a C₁ to C₂₀ hydrocarbon group, a heteroatom containing group, silicon, germanium, tin, lead, phosphorus, a halogen,

R¹ and R² may also be interconnected to each other,

R³ is absent, or is hydrogen, a group 14 atom containing group, a halogen, a heteroatom containing group,

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R⁴ and R⁵ are independently an aryl group, a substituted aryl group, a cyclic alkyl group, a substituted cyclic alkyl group, or multiple ring system,

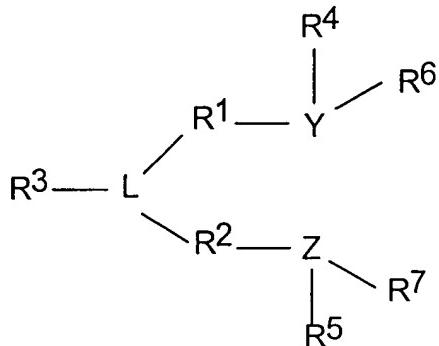
R⁶ and R⁷ are independently absent or hydrogen, halogen, a heteroatom or a hydrocarbyl group, or a heteroatom containing group.

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34. A method to prepare a metal adduct comprising reacting a neutral ligand with a compound represented by the formula MⁿX_n (where M is Zr or Hf, n is the oxidation state of M, X is a halogen) in a non-coordinating or weakly coordinating solvent, at 20°C or more, then recovering the metal adduct.

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35. The method of claim 34, wherein the neutral ligand is represented by the formula:



Y is a group 15 element,

15 Z is a group 15 element,

L is a group 15 or 16 element,

R¹ and R² are independently a C₁ to C₂₀ hydrocarbon group, a heteroatom containing group, silicon, germanium, tin, lead, phosphorus, a halogen,

R¹ and R² may also be interconnected to each other,

20 R³ is absent, or is hydrogen, a group 14 atom containing group, a halogen, a heteroatom containing group,

R⁴ and R⁵ are independently an aryl group, a substituted aryl group, a cyclic alkyl group, a substituted cyclic alkyl group, or multiple ring system,

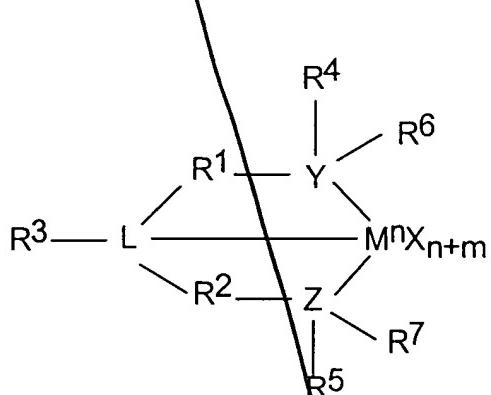
R³work

R⁶ and R⁷ are independently absent or hydrogen, halogen, a heteroatom or a hydrocarbyl group, or a heteroatom containing group

36. The reaction product of a neutral ligand reacted with a compound represented by

5 the formula MⁿX_n (where M is Zr or Hf, n is the oxidation state of M, X is an anionic leaving group), in a non-coordinating or weakly coordinating solvent at about 20 to about 100 °C.

37. A composition represented by the formula:



wherein

M is a group 3 to 14 metal,

each X is independently an anionic leaving group,

15 n is the oxidation state of M,

m is the formal charge of the YZL ligand,

Y is a group 15 element,

Z is a group 15 element,

L is a group 15 or 16 element,

20 R¹ and R² are independently a C₁ to C₂₀ hydrocarbon group, a heteroatom containing group, silicon, germanium, tin, lead, phosphorus, a halogen,

R¹ and R² may also be interconnected to each other,

R³ is absent, or is hydrogen, a group 14 atom containing group, a halogen, a heteroatom containing group,

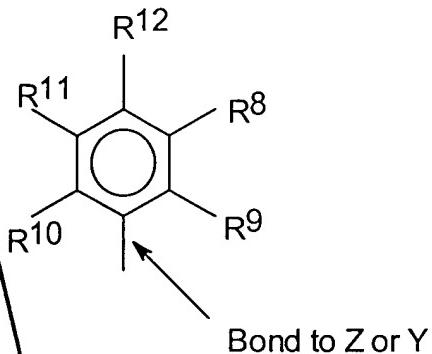
Q3 cont'

~~R⁴ and R⁵ are independently an aryl group, a substituted aryl group, a cyclic alkyl group, a substituted cyclic alkyl group, or multiple ring system,
R⁶ and R⁷ are independently absent or hydrogen, halogen, a heteroatom or a hydrocarbyl group, or a heteroatom containing group.~~

- 5
9 38. The composition of claim ~~37~~⁸ wherein M is a group 4, 5 or 6 transition metal.
- 10 39. The composition of claim ~~37~~⁸ wherein M is zirconium or hafnium.
- 10/11 40. The composition of claim ~~37~~⁸ wherein each X is independently hydrogen, halogen or a hydrocarbyl group.
- 11 41. The composition of claim ~~37~~⁸, wherein R¹ and R² are independently a C₁ to C₆ hydrocarbon group.
- 13 42. The composition of claim ~~37~~⁸, wherein R¹ and R² are a C₁ to C₂₀ alkyl, aryl or aralkyl group.
- 14 43. The composition of claim ~~37~~⁸ wherein m is 0, -1, -2, or -3 and n is +3, +4 or +5.
- 14/20 44. The composition of claim 37 wherein R³ is absent or hydrogen or methyl.
- 25 45. The composition of claim 37 wherein R⁴ and R⁵ are independently a C₁ to C₂₀ hydrocarbon group.
46. The composition of claim 37 wherein R⁴ and R⁵ are independently a C₁ to C₂₀ aryl group or a C₁ to C₂₀ aralkyl group.
- 30 47. The composition of claim 37 wherein R⁴ and R⁵ are independently a cyclic aralkyl group.

Altcont'

48. The composition of claim 37 wherein R⁴ and R⁵ are independently a group represented by the following formula:



wherein

each R⁸ to R¹² are independently hydrogen, or a C₁ to C₂₀ alkyl group, a heteroatom, or a heteroatom containing group having up to 40 carbon atoms, and any two R groups can combine to form a cyclic group or a heterocyclic group.

49. The composition of claim 48 wherein

R⁸ is methyl, ethyl, propyl or butyl and/or

R⁹ is methyl, ethyl, propyl or butyl, and/or

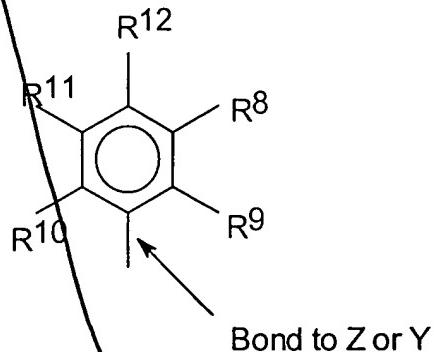
R¹⁰ is methyl, ethyl, propyl or butyl, and/or

R¹¹ is methyl, ethyl, propyl or butyl and/or

R¹² is methyl, ethyl, propyl or butyl.

- 21 50. The composition of claim 37 wherein R⁹, R¹⁰ and R¹² are methyl and R⁸ and R¹¹
20 are hydrogen.

125 51. The composition of claim ~~37~~ wherein M is zirconium, each of Y, A and L is nitrogen, each of R¹ and R² is -CH₂-CH₂, R³ is hydrogen, R⁶ and R⁷ are absent and each of R⁴ and R⁵ is a group represented by the formula:



wherein

each R⁸ to R¹² are independently hydrogen, or a C₁ to C₂₀ alkyl group, a heteroatom, or a heteroatom containing group having up to 40 carbon atoms, and any two R groups can combine to form a cyclic group or a heterocyclic group.

23 52. The composition of claim ~~51~~ ²¹ wherein each of R⁴ and R⁵ is represented by the formula:

